Title: Development of selectivity models to infer on fish escapement processes in a trawl
18 months in full time – Starting date between September, 15th and December, 15th 2020

The Institute and the recruiting department

French Research Institute for Exploitation of the Sea, Ifremer, through its research work and expert advice, contributes to knowledge of the oceans and their resources, to monitoring of marine and coastal environments and to the sustainable development of marine activities. To these ends, Ifremer conceives and operates tools for observation, experimentation and monitoring, and manage the oceanographic databases.

Created in 1984, Ifremer is a French public institute of an industrial and commercial nature. It is supervised jointly by the Ministry of Higher Education and Research and the Ministry of the Environment, Energy and Marine Affairs.

Ifremer undertakes research missions, offers expert advice and acts as a funding agency.

Ifremer performs targeted applied research to address the questions posed by society (climate change effects, marine biodiversity, pollution prevention, seafood quality etc.). Results include scientific knowledge, technological innovations, and systems for ocean observation and exploration. Partnerships may be public, private or a combination of the two.

Presentation of the department/direction, research unit or laboratory/service:

The main challenges are to contribute to changes leading to the exploitation of ecologically sustainable and socio-economically profitable fishery resources. They are part of the implementation of the ecosystem approach to fisheries in a renewed regulatory context (Marine Strategy Framework Directive, Common Fisheries Policy).

The research themes of the STH (Fisheries Science and Technology) unit revolve around three axes: improving knowledge of the biology and ecology of exploited species, the study of uses / ecosystem interactions and development of stock assessment methods in the context of the ecosystem approach to fisheries.

Context of the project:

This position positioned within the Laboratory of Fisheries Technology and Biology (LTBH) in Lorient is in line with the objectives of the Common Fisheries Policy: while maintaining the food supply and the economic balance of the fisheries, improving the selectivity of fishing gears to reduce discards is an important and complex issue, particularly for mixed fisheries. Numerous studies have been carried out in partnership between fishing professionals and scientists and have made it possible to develop and test new devices from an operational point of view on different fleets and fishing zones around the world.

These studies are generally based on experiments at sea in which the catches are sampled by species and by size. Two types of experiments are generally carried out, depending on the objective of the study. If it is desired to determine the selectivity in absolute size of a new fishing gear or device, a control must be carried out using a cover or a very small mesh gear. But very often the objective is to estimate the gains in selectivity and the potential commercial losses associated with the device tested compared to the standard commercial device for the use and acceptance of the devices by professionals. A protocol directly comparing the two devices (in parallel or alternating lines) is therefore often preferred (Veiga-Malta et al., 2018). In this case, only a relative selectivity is estimated. While these protocols for collecting selectivity data are well known and established, the inference of these data is not trivial and still raises a certain number of questions which call for potential avenues for improvement (Holst and Revill, 2009; Krag et al., 2014; Millar and Fryer, 1999; Miller, 2013; Punt et al., 2014).

In addition, the experiments at sea being very expensive, the protocol directly comparing the two devices is often preferred. In this case, only relative selectivity can be estimated while absolute selectivity is valuable from a scientific point of view to understand the impact of fishing on populations.

References

Holst, R., Revill, A., 2009. A simple statistical method for catch comparison studies. Fish. Res. 95, 254–259. https://doi.org/10.1016/j.fishres.2008.09.027

Krag, L.A., Herrmann, B., Karlsen, J.D., 2014. Inferring Fish Escape Behaviour in Trawls Based on Catch Comparison Data: Model Development and Evaluation Based on Data from Skagerrak, Denmark (vol 9, e88819, 2014). Plos One 9, e100605. https://doi.org/10.1371/journal.pone.0100605

Millar, R.B., Fryer, R.J., 1999. Estimating the size-selection curves of towed gears, traps, nets and hooks. Rev. Fish Biol. Fish. 9, 89–116. https://doi.org/10.1023/A:1008838220001

Miller, T.J., 2013. A comparison of hierarchical models for relative catch efficiency based on paired-gear data for US Northwest Atlantic fish stocks. Can. J. Fish. Aquat. Sci. 70, 1306–1316. https://doi.org/10.1139/cjfas-2013-0136

Punt, A.E., Hurtado-Ferro, F., Whitten, A.R., 2014. Model selection for selectivity in fisheries stock assessments. Fish. Res., SI: Selectivity 158, 124–134. https://doi.org/10.1016/j.fishres.2013.06.003

Veiga-Malta, T., Feekings, J., Herrmann, B., Krag, L.A., 2018. When is enough, enough? Quantifying trade-offs between information quality and sampling effort for fishing gear selectivity data. PLOS ONE 13, e0199655. https://doi.org/10.1371/journal.pone.0199655

General areas of responsibility (principal missions)

This project aims to synthetize and compare the usual selectivity models to develop new ones that increase the estimates precision and our understanding of the underlying fish escapement processes from fishing gear.

Principal activities

- Make a review of the existing models, identify their limits and propose improvements using case studies (selectivity data will be provided from our past projects CELSELECT and REJEMCELEC). We propose to adopt a more mechanistic approach to account for escapement processes and account for the aggregated nature of such data. The combination with other kind of data (e.g. environment, "fall-through", video) could also be investigated.

- Develop a method to infer the absolute selectivity of a tested device from both the absolute selectivity of the standard device and the relative selectivity of the two devices. A simulation approach could be used to test this method as well as to define optimal sampling protocols for future experiments.

Collaborative work environment

Internal collaborative relationship: Fisheries and Technology units of the institute

External collaborative relationship: ICES group WGTFB

Required knowledge, skills, and characteristics

- <u>Knowledge, skills, and abilities:</u>
- Ability to independently carry out research

- Data analysis and modeling

- Experience in R or other computing language is mandatory

- Redaction of scientific papers in english

- <u>Human qualities:</u>
- Organization, autonomy and rigor

- Teamwork

- Ability to take initiative and communicate

Furthermore, the candidate should have spent **at least 18 months abroad (outside France) since May, 2016.**

Required education and experience

Ph.D. in Statistics or applied mathematics with strong interest in marine environment and fisheries sciences
    Or
Ph.D. in Marine ecology, quantitative ecology, fisheries, natural resource management (or related fields) with strong interest and skills in data analysis and modeling approaches.

Specific working conditions

Trips to participate to working groups or research conferences, opportunity to take part to at-sea experiments aboard fishing or scientific vessel.

Deadline for applications: September 13th, 2020

Informal enquiries may be made to marie.morfin@ifremer.fr or marianne.robert@ifremer.fr.

All applications are processed exclusively via our website:
https://domicile.ifremer.fr/en-GB/job/post-doctoral-research-position-in-fisheries-modeling/,DanaInfo=ifremer-en.jobs.net,SSL+J3S2NB61V7J5LY2HSZL

Interested candidates can apply by clicking the **"Apply"** button. If you are unable to apply online please contact us at *grh@ifremer.fr*